

REMARKS/ARGUMENTS

Favorable reconsideration of this application, in light of the following discussion, is respectfully requested.

Claims 1-3, 6-8 and 31-45 are presently active in the present application. Claims 4, 5 and 9-30 have been canceled. Claims 1 and 6 have been amended, and Claims 31-45 have been added. No new matter was added.¹

In the Office Action, Claims 1-2 and 4-8 were rejected under 35 U.S.C. §103(a) as being unpatentable over Sano et al (U.S. Patent No. 6,407,405) in view of Boydston et al (U.S. Patent No. 6,375,749).

REASONS FOR ALLOWANCE

Claim 1 defines:

A substrate processing apparatus comprising:
a processing vessel forming a processing space, a sidewall of the processing vessel having a rectangular section;
a rotatable supporting table for supporting a substrate to be processed in the processing space;
a rotation mechanism of the supporting table;
a nitrogen radical generation unit, provided at a first plane of the sidewall of the processing vessel at a first side of the supporting table, for forming nitrogen radicals by a high frequency plasma and supplying the nitrogen radicals into the processing space, the nitrogen radicals flowing along a surface to be processed of the substrate from the first side to a second side, the second side facing the first side with the substrate to be processed placed therebetween;
an oxygen radical generation unit, provided at the first plane of the sidewall at the first side, for forming oxygen radicals by a high frequency plasma and supplying the oxygen radicals into the processing space, the oxygen radicals flowing along the surface to be processed of the substrate from the first side to the second side; and
a gas exhaust path, provided at an end portion at the second side, to exhaust the processing space,
wherein the nitrogen radicals and the oxygen radicals flow towards the gas exhaust path from the nitrogen radical generation unit and the oxygen


¹ The amendments to Claim 1 are supported in Figs. 4 and 5. Claims 31 and 44 are supported in specification page 25, line 14-20. Claims 32 and 45 are supported in Figs. 4 and 6A. Added Claims 33-43 are similar to original Claims 1-8 and are supported by the specification.

radical generation unit while forming a nitrogen radical flow path and an oxygen radical flow path along the surface of the substrate to be processed, respectively.

In accordance with Claim 1, the nitrogen radical generation unit and the oxygen radical generation unit are provided at a first plane of the sidewall of the processing vessel at a first side of the supporting table, and the gas exhaust path is provided at an end portion at the second side, the second side facing the first side with the substrate placed therebetween. Thereby, the nitrogen and oxygen radicals flow along a surface of the substrate to be processed from the first side to a second side.

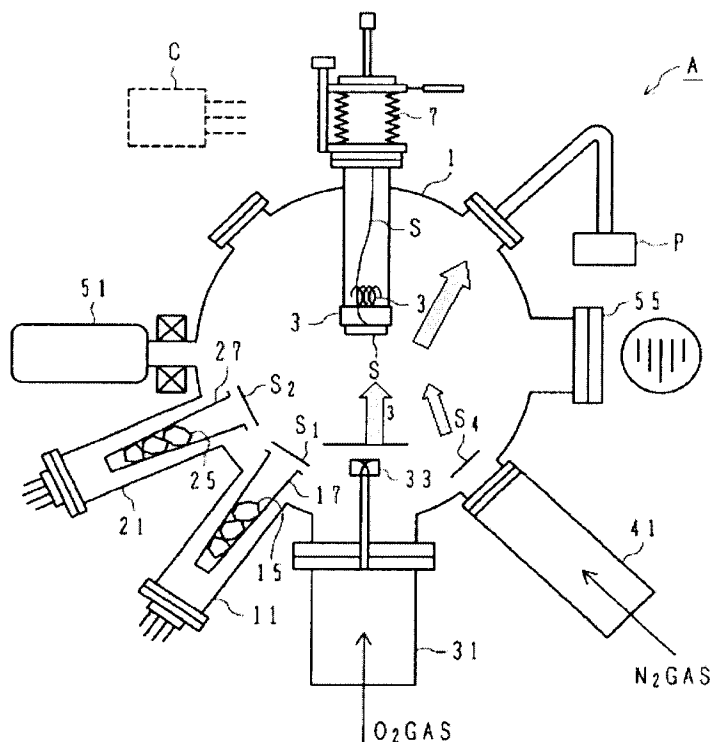
Since the nitrogen radicals and the oxygen radicals are injected into the processing vessel substantially parallel to the surface of the substrate, the nitrogen radicals and the oxygen radicals (as claimed) flow towards the gas exhaust path from the nitrogen radical generation unit and the oxygen radical generation unit, while forming a nitrogen radical flow path and an oxygen radical flow path along the surface of the substrate to be processed, respectively.

The Office Action in rejecting Claim 1 asserts that Sano teaches nitrogen radicals flowing along a surface to be processed of the substrate from the first side to a second side. In particular, the Office Action notes on page 3 label "P," vacuum pump #2, col. 3, line 4.

However, in Sano, N radicals and O radicals flow to the substrate vertically with respect to the surface of the substrate. Reproduced below on the next page is Figure 1 of Sano in which gas flow direction arrows  from the N₂ gas source and the O₂ gas source to the pump have been added.

It is clear that the gas flow directions in Sano are not along substrate S.

FIG.1



Thus, Sano does **not** disclose, teach, or suggest that the radicals injected from the radical generation units 31 and 42 flow along (i.e., flow parallel to) the surface to be processed. Therefore, Sano fails to disclose:

- 1) a nitrogen radical generation unit, provided at a first plane of the sidewall of the processing vessel at a first side of the supporting table, for forming nitrogen radicals by a high frequency plasma and supplying the nitrogen radicals into the processing space, the nitrogen radicals ***flowing along a surface to be processed of the substrate*** from the first side to a second side, the second side facing the first side with the substrate to be processed placed therebetween, or
- 2) an oxygen radical generation unit, provided at the first plane of the sidewall at the first side, for forming oxygen radicals by a high frequency plasma and supplying the oxygen radicals into the processing space, ***the***

oxygen radicals flowing along the surface to be processed of the substrate
from the first side to the second side.

Therefore, it is respectfully submitted that the rejection to Claim 1 be withdrawn.

Hence, Claim 1 and the claims dependent therefrom patentably define over the applied art.

For similar reasons, newly added independent Claim 33 and the claims dependent therefrom patentably define over the applied art.

Regarding various ones of the dependent claims:

M.P.E.P. § 2143.03 requires that all words in a claim must be considered in judging the patentability of the claim against the prior art. The Office Action stated with regard to dependent Claims 4, 5, and 6 that recitations such “distance” and “at a center of the substrate to be processed” were interpreted in the Office Action to be intended use limitations and apparently given no patentable weight.

However, the above limitations define the displacement and arrangement of the claimed devices respectively. In other words, the claim language sets forth such structural relationships and is not an “intended use” limitation. For example, Claim 6 (the only remaining one of these claims) defines that a center of the nitrogen radical flow path intersects with that of the oxygen radical flow path in the processing vessel, thus establishing a relationship between the nitrogen radical generation unit and the oxygen radical generation unit.

Applicant submits that this feature is also not disclosed or suggested in the applied art. Hence, for this reason and its dependence on Claim 1, Claim 4 should be passed to allowance.

Regarding Claims 31 and 44, Applicants submit that Sano, Boydston, and Anders do not disclose, teach, or suggest that the nitrogen radical generation unit and the oxygen radical

generation unit 1) are installed adjacent to each other and 2) are in plane symmetry with respect to an adjacent surface between the nitrogen radical generation unit and the oxygen radical generation unit. Hence, for this reason and their dependence on independent claims, dependent Claims 31 and 44 should be passed to allowance.

Regarding Claims 37-39, the recitations of Claims 37-39 are not intended-use as stated above, and Sano, Boydston, and Anders do not disclose, teach or suggest the features of Claims 37-39. Hence, for this reason and their dependence on independent claims, dependent Claims 37-39 should be passed to allowance.

Regarding Claims 40-43, the flow adjusting plate changes the first or second flow path into the processing space(or to a center of the substrate). However, the shutter of Sano only can open/close the O radical port and the N radical port, and does not change the flow path of the O radical or the N radical into the processing space (or to a center of the substrate). Hence, for this reason and their dependence on independent claims, dependent Claims 40-43 should be passed to allowance.

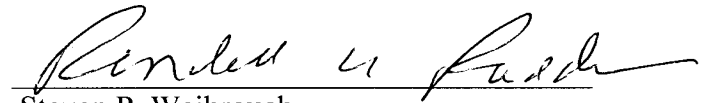
Conclusion:

In light of the above discussions, the outstanding grounds for rejection are believed to have been overcome. The application is believed to be in condition for formal allowance.

An early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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